(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: 0 338 077 A1

(12) EUROPEAN PATENT APPLICATION
published in accordance with Art. 158(3) EPC

(21) Application number: 88906899.5

(51) Int. Cl.4: G05B 19/04

(22) Date of filing: 10.08.88

(86) International application number:
PCT/JP88/00789

(87) International publication number:
WO 89/01656 (23.02.89 89/05)

(30) Priority: 12.08.87 JP 201597/87

(43) Date of publication of application:
25.10.89 Bulletin 89/43

(84) Designated Contracting States:
DE FR GB

(71) Applicant: FANUC LTD
3580, Shibokusa Aza-Komanba Oshino-mura
Minamitsuru-gun Yamanashi 401-05(JP)

(72) Inventor: YAMAUCHI, Takashi Fanuc Mansion Harimomi 6-202
3537-1, Shibokusa Oshinomura,
Minamitsuru-gun
Yamanashi 401-05(JP)

(74) Representative: Brunner, Michael John et al
GILL JENNINGS & EVERY 53-64 Chancery Lane
London WC2A 1HN(GB)

(54) HIGH-SPEED INPUT/OUTPUT MODULE AND PLC APPARATUS.

(57) A PLC apparatus that performs operation processing of a sequence program using a micro-processor. The PLC apparatus has a PLC control unit (10) and a high-speed input/output module (20) that performs logic operation at high speeds in response to input signals from an external unit and that produces the result of logic operation to an external unit. Therefore, external signals can be processed at high speeds without the need for any particular processor.

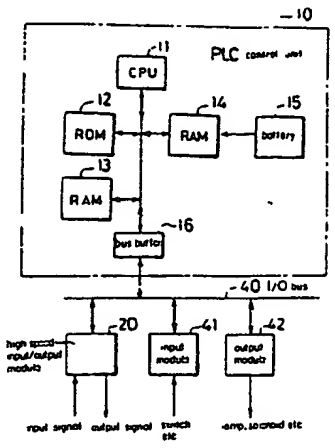

Fig. 1

EP 0 338 077 A1

HIGH-SPEED INPUT/OUTPUT MODULE AND PLC APPARATUS

TECHNICAL FIELD

The present invention relates to a PLC device (programmable logic control device), and more specifically, to a PLC device provided with a high speed input/output module capable of processing an input/output signal at a high speed.

BACKGROUND ART

A PLC device processes a sequence program by receiving an input signal and outputs an output signal as a result thereof, and repeatedly executes this cycle. A scanning time (process time) of the sequence program is usually about several milliseconds to one hundred milliseconds, and most controls are executed during that time, but some controls must be partially processed at a very high speed, e.g., in a very short time such as one millisecond or less.

Conventionally, a special unit is provided for the high speed processing, wherein a signal is transmitted between the special unit and a PLC device for effecting an overall control.

This special control unit, however, is cumbersome as a system and requires a large space for the installation. Further, an interface between the PLC device and the special unit is complex.

DISCLOSURE OF THE INVENTION

An object of the present invention is to solve the above problems and to provide a PLC device provided with a high speed input/output module capable of processing an input/output signal at a high speed without using a special high speed processing unit.

To solve the above problems, in accordance with a first embodiment of the present invention, there is provided a high speed input/output module used for a PLC device, a numerical control apparatus and the like, comprising:

a programmable logical operation element which executes a logical operation at a high speed in response to an external input signal and an output from a PLC control unit, and the like, externally outputs a result of the logical operation, and inputs the result to the PLC control unit, and the like.

Further, in accordance with a second embodiment of the present invention, there is provided a PLC device executing a logical operation process of a sequence program by a microprocessor, comprising:

a programmable logical operation element which includes a high speed input/output module able to execute a logical operation at a high speed in response to an external input signal and an output from a PLC control unit, externally output a result of the logical operation, and input the result to the PLC control unit.

The logical operation element can independently execute a simple operation process, and processes an input/output which must be processed at a high speed, and externally outputs same. When necessary, the element later transmits it to a PLC control unit.

This high speed module is coupled with the PLC device, a numerical control apparatus or the like, and processes an external signal which must be processed at a high speed.

In addition, an arrangement of the PLC device including this high speed module processes the external signal which must be processed at a high speed, without the need for a special processing unit.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of an overall PLC device of an embodiment of the present invention; and

FIG. 2 is a detailed diagram of a high speed input/output module.

BEST MODE OF CARRYING OUT THE INVENTION

An embodiment of the present invention will be hereinafter described in detail with reference to the drawings.

FIG. 1 is a block diagram of an overall PLC device of an embodiment of the present invention, wherein 10 designates a PLC control unit as a center for controlling the PLC device; 20 designates a high speed input/output module for processing an input/output signal to be processed at a high speed, which will be described later in detail; 41 designates an input module for receiving an input signal from a switch or the like and applies the input signal to the PLC control unit through an I/O bus; and 42 designates an output module for

receiving an output signal from the PLC control unit 10 through the I/O bus 40, and outputs same to energize a lamp, a solenoid and the like.

Next, the interior of the PLC control unit 10 will be described. Designated at 11 is a microprocessor for controlling the overall PLC device; designated at 12 is a ROM in which a system program is stored, the microprocessor 11 controlling the PLC device in accordance with the system program in the ROM 12; designated at 13 is a RAM for a workpiece in which data and the like is stored; and designated at 14 is a RAM in which a sequence program and the like for a sequence processing is stored. The sequence program is used for regulating the operation of a machine which is actually controlled by the PLC device, and can be changed in midcourse in accordance with a change in the operation of the machine. The RAM 14 is backed up by a battery 15 to maintain the sequence program when a power supply is turned off.

A usual signal, which need not be processed at a high speed, is received from the input module 41, processed in accordance with the sequence program, and output from the output module 42. A signal to be processed at a high speed is input to the high speed input/output module 20, processed in the interior thereof, and output from the high speed input and output module 20. If necessary, a result of the output is later transmitted to the PLC control unit 10. For example, the signal to be processed at a high speed is a signal to be output in correspondence with a signal received from an external absolute encoder mounted on a shaft rotating at a high speed.

Next, the high speed input/output module 20 will be described in detail. FIG. 2 is a detailed diagram of the high speed input/output module 20, wherein 21 designates a buffer as an interface with the I/O bus 40; 22 designates a bus buffer for applying an input signal and the like to the I/O bus 40 through the bus buffer 21; 23 designates a latch for temporarily storing a signal from the PLC control unit 10; 24 designates a latch for storing an input signal and a signal from the latch 23 in synchronism with a clock of a clock circuit 25; 26 designates an EPROM programmed to output a specific output pattern to a certain input to thereby execute a logic operation; 27 designates a latch for storing an output from the EPROM 26 in synchronism with a clock of the clock circuit 25; 28 designates an input circuit comprising a receiver; and 29 designates an output circuit comprising a driver.

Next, the operation of the high speed input/output module 20 will be described. When a signal to be processed at a high speed is received by the input circuit 28, the signal is applied to the EPROM 26 through the latch 24, and thus a logical operation predetermined by a program is executed. For example, the EPROM 26 receives a signal from the absolute encoder mounted on the shaft rotating at a high speed, as described above, and outputs a pattern signal corresponding to that signal. The output signal from the EPROM 26 is stored in the latch 27 and externally output from the output circuit 29 for controlling an external apparatus at a high speed. If the output signal is required by the PLC control unit 10, it is transmitted thereto through the bus buffers 22 and 21.

A signal which need not be processed at a high speed is received by the input circuit 28 and transmitted to the PLC control unit 10 as it is, through the bus buffers 22, 21. Conversely, the usual output is externally output from the output circuit 29 through the bus buffer 21 and the latch 23.

Although the high speed logical operation element is described as an EPROM in the above description, a PLD (programmable logic device) or the like, for example, may be used instead of the EPROM.

A RAM also may be used instead of the EPROM, and when a RAM is used, a greater flexibility can be provided because a logical operation to be processed at a high speed, an input signal, and the like can be rewritten in response to a command from the PLC control unit 10.

According to the present invention, as described above, since a high speed input/output module is provided which includes a logical operation element capable of processing an input/output signal at a high speed, the high speed input/output module can be coupled with a PLC device or the like, instead of a special high speed processing unit, to process an external signal at a high speed.

In addition, since the PLC device includes the high speed input/output module provided with the logical operation element capable of processing an input/output signal at a high speed, an external signal to be processed at a high speed can be processed without using a special high speed processing unit.

Claims

1. A high speed input/output module used for a PLC device, a numerical control apparatus and the like, comprising:
a programmable logical operation element which executes a logical operation at a high speed in response to an external input signal, and an output from a PLC control unit and the like, externally outputs a result of the logical operation, and inputs a result to the PLC control unit and the like.

2. A high speed input/output module according to claim 1, wherein said logical operation element is an EPROM.

3. A high speed input/output module according to claim 1, wherein said logical operation element is a PLD (programmable logic device).

4. A high speed input/output module according to claim 1, wherein said logical operation element is a RAM.

5. A PLC device executing a logical operation process of a sequence program by a microprocessor, comprising:
a high speed input/output module which includes a programmable logical operation element able to execute a logical operation at a high speed in response to an external input signal and an output from a PLC control unit, externally output a result of the logical operation, and input the result to the PLC control unit.

6. A PLC device according to claim 5, wherein said logical operation element is an EPROM.

7. A PLC device according to claim 5, wherein said logical operation element is a PLD (programmable logic device).

8. A PLC device according to claim 5, wherein said logical operation unit is a RAM.

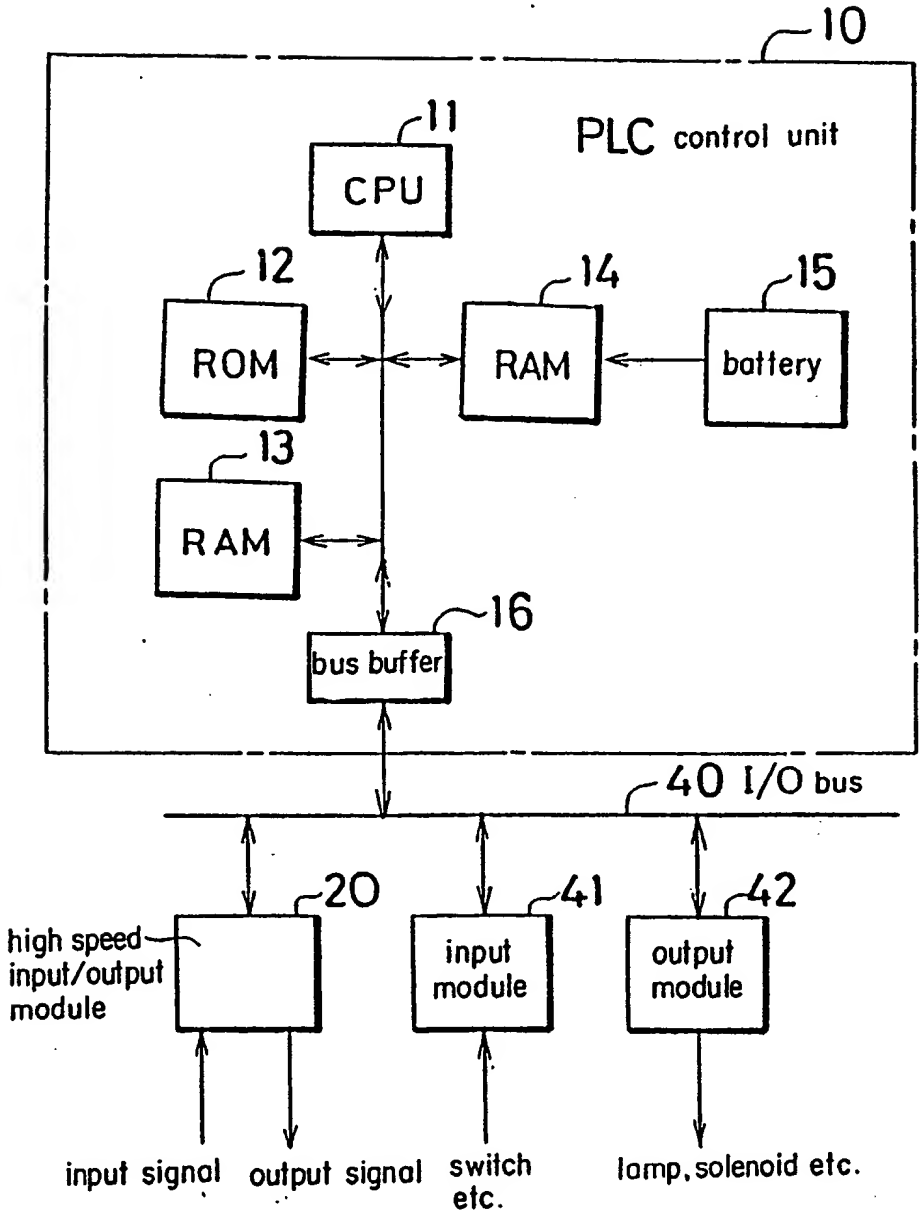
10
PLC control unit
11
CPU
12
ROM
13
RAM
14
RAM
15
battery
16
bus buffer
40 I/O bus
20
high speed input/output module
41
input module
42
output module
input signal
output signal
switch etc.
lamp, solenoid etc.

Fig. 1

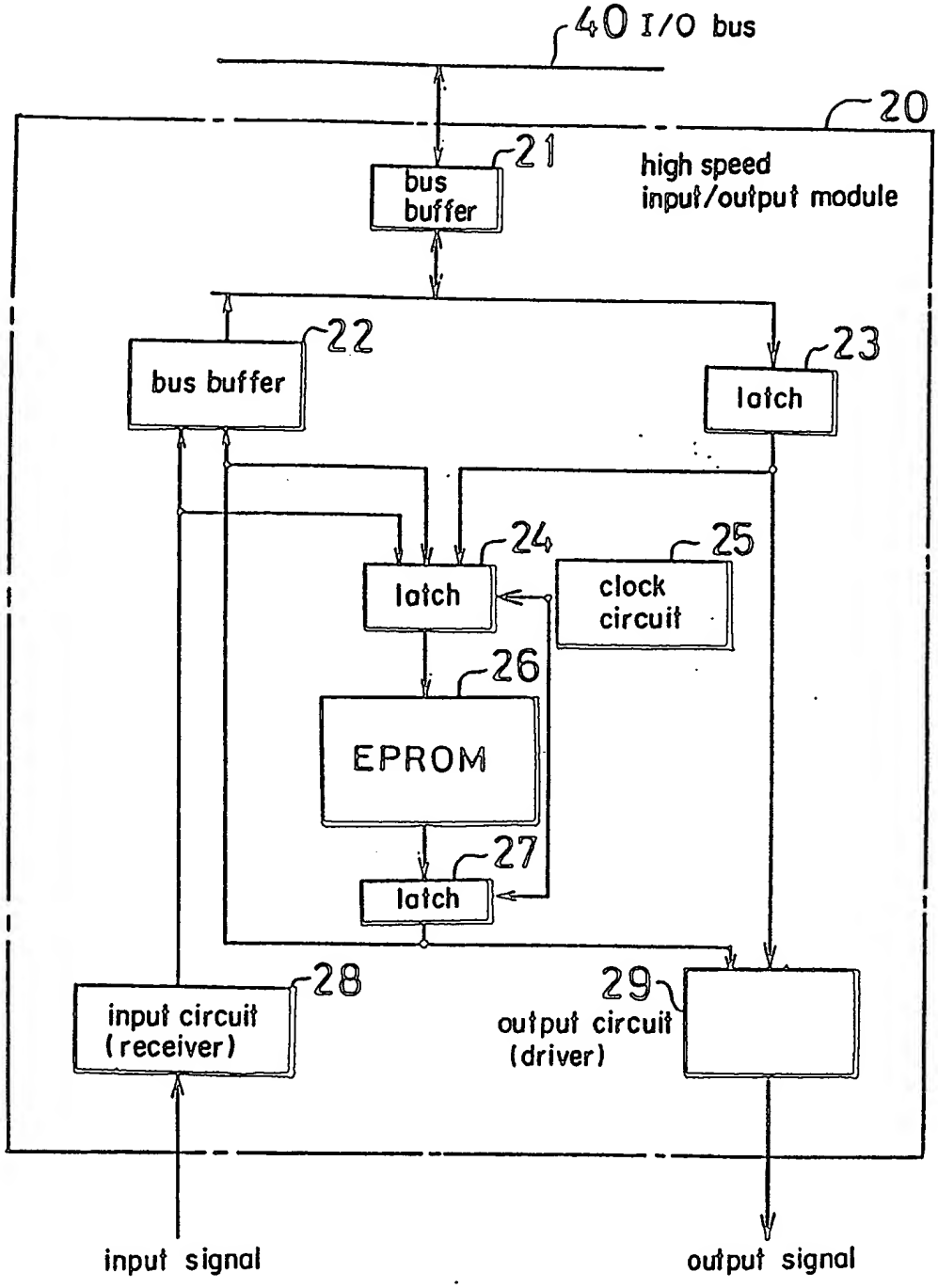
40 I/O bus
20
21
bus buffer
high speed input/output module
22
bus buffer
23
latch
24
latch
25
clock circuit
26
EPROM
27
latch
28
input circuit (receiver)
29
output circuit (driver)
input signal
output signal

Fig. 2

INTERNATIONAL SEARCH REPORT

International Application No PCT/JP88/00789

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl[4] G05B19/04

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC	G05B19/04

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

Jitsuyo Shinan Koho 1932 - 1988
Kokai Jitsuyo Shinan Koho 1971 - 1988

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
X	JP, A, 58-186804 (Koyo Electronics Industries Co., Ltd.) 31 October 1983 (31. 10. 83) (Family: none)	1-8
Y	JP, B2, 59-27929 (Toyoda Machine Works, Ltd.) 9 July 1984 (09. 07. 84) & US, A, 4176403	1-8
Y	JP, A, 61-264405 (Hitachi, Ltd.) 22 November 1986 (22. 11. 86) (Family: none)	1-8

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
October 27, 1988 (27. 10. 88)	November 14, 1988 (14. 11. 88)
International Searching Authority	**Signature of Authorized Officer**
Japanese Patent Office	